

Nausea/Vomiting

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Introduction

Nausea and vomiting occur in response to conditions that affect the vomiting center in the area postrema of the brain. Causes may originate in the gastrointestinal (GI) tract, the central nervous system (CNS), or may result from a number of systemic conditions. The most common causes of nausea and vomiting terrestrially include gastroenteritis, medication side effects, and exposure to toxins.^[1] During space flight the most common cause of nausea and vomiting is space motion sickness^[2], which is addressed separately on a dedicated medical condition page ([https://humanresearchwiki.jsc.nasa.gov/index.php?title=Space_Motion_Sickness_\(Space_Adaptation\)\)](https://humanresearchwiki.jsc.nasa.gov/index.php?title=Space_Motion_Sickness_(Space_Adaptation))).

Severe vomiting can lead to symptomatic dehydration and electrolyte abnormalities; typically a metabolic alkalosis with hypokalemia. Rarely it can result in an esophageal tear, either partial (Mallory-Weiss) or complete (Boerhaave's syndrome). Chronic vomiting can result in under-nutrition, weight loss, or metabolic abnormalities.^[1]
^[3]

The evaluation of gastrointestinal disorders on orbit proves to be a challenge compared to that on the ground. Symptoms may present in a different way due to re-positioning of the organs and mesentery as well as elevation of the diaphragm.^[2]

Clinical Priority and Clinical Priority Rationale by Design Reference Mission

One of the inherent properties of space flight is a limitation in available mass, power, and volume within the space craft. These limitations mandate prioritization of what medical equipment and consumables are manifested for the flight, and which medical conditions would be addressed. Therefore, clinical priorities have been assigned to describe which medical conditions will be allocated resources for diagnosis and treatment. “Shall” conditions are those for which diagnostic and treatment capability must be provided, due to a high likelihood of their occurrence and severe consequence if the condition were to occur and no treatment was available. “Should” conditions are

those for which diagnostic and treatment capability should be provided if mass/power/volume limitations allow. Conditions were designated as “Not Addressed” if no specific diagnostic and/or treatment capability are expected to be manifested, either due to a very low likelihood of occurrence or other limitations (for example, in medical training, hardware, or consumables) that would preclude treatment. Design Reference Missions (DRMs) are proposed future missions designated by a set of assumptions that encompass parameters such as destination, length of mission, number of crewmembers, number of Extravehicular Activities (EVAs), and anticipated level of care. The clinical priorities for all medical conditions on the Exploration Medical Condition List (EMCL) can be found here (https://humanresearchwiki.jsc.nasa.gov/index.php?title=Category:All_DRM). The EMCL document may be accessed here (https://humanresearchwiki.jsc.nasa.gov/images/6/62/EMCL_RevC_2013.pdf).

Design Reference Mission	Clinical Priority	Clinical Priority Rationale
<p>Lunar sortie mission</p> <p>Assumptions:</p> <ul style="list-style-type: none"> 4 crewmembers (3 males, 1 female) 14 days total 4 EVAs/ crewmember <u>Level of Care 3</u> 	Shall	Nausea and vomiting are expected to occur secondary to various causes during a lunar sortie mission, and without treatment may lead to dehydration and difficulty with task completion. Therefore, treatment capability shall be manifested.
<p>Lunar outpost mission</p> <p>Assumptions:</p> <ul style="list-style-type: none"> 4 crewmembers (3 males, 1 female) 180 days total 90 EVAs/ crewmember <u>Level of Care 4</u> 	Shall	Nausea and vomiting are expected to occur secondary to various causes during a lunar outpost mission, and without treatment may lead to dehydration and difficulty with task completion. Therefore, treatment capability shall be manifested.
<p>Near-Earth Asteroid (NEA) mission</p> <p>Assumptions:</p> <ul style="list-style-type: none"> 3 crewmembers (2 males, 1 female) 395 days total 30 EVAs/ crewmember <u>Level of Care 5</u> 	Shall	Nausea and vomiting are expected to occur secondary to various causes during the NEA mission, and without treatment may lead to dehydration and difficulty with task completion. Therefore, treatment capability shall be manifested.

Initial Treatment Steps During Space Flight

A link is provided to a prior version of the International Space Station (ISS) Medical Checklist, which outlines the initial diagnostic and treatment steps recommended during space flight for various conditions which may be encountered onboard the ISS. Further diagnostic and treatment procedures beyond the initial steps outlined in the Medical Checklist are then recommended by the ground-based Flight Surgeon, depending on the clinical scenario. Please note that this version does not represent current diagnostic or treatment capabilities available on the ISS. While more recent versions of this document are not accessible to the general public, the provided version of the checklist can still provide a general sense of how medical conditions are handled in the space flight environment. Medical Checklists will be developed for exploration missions at a later point in time.

Please note this file is over 20 megabytes (MB) in size, and may take a few minutes to fully download.

ISS Medical Checklist (http://www.nasa.gov/centers/johnson/pdf/163533main_ISS_Med_CL.pdf)

Capabilities Needed for Diagnosis

The following is a hypothetical list of capabilities that would be helpful in diagnosis. It does not necessarily represent the current capabilities available onboard current spacecraft or on the ISS, and may include capabilities that are not yet feasible in the space flight environment.

- Vital signs measurement capability (blood pressure, pulse, respiratory rate, temperature, as required per the patient's clinical state)
- Auscultation device (such as a stethoscope, for bowel sounds)
- Blood analysis (to check electrolytes, if prolonged vomiting)

Capabilities Needed for Treatment

The following is a hypothetical list of capabilities that would be helpful in treatment. It does not necessarily represent the current capabilities available onboard current spacecraft or on the ISS, and may include capabilities that are not yet feasible in the space flight environment.

- Crew medical restraint system
- Antiemetics [oral, intramuscular (IM), intravenous (IV)]
- Medication delivery device (such as a Carpuject)
- Skin cleanser [such as alcohol/Benzalkonium antiseptic (BZK)/iodine]
- Emesis bags
- Intravascular volume replacement (such as IV fluids)
- IV start and administration kit

Associated Gap Reports

The NASA Human Research Program (HRP) identifies gaps in knowledge about the health risks associated with human space travel and the ability to mitigate such risks. The overall objective is to identify gaps critical to human space missions and close them through research and development. The gap reports that are applicable to this medical condition are listed below. A link to all of the HRP gaps can be found here (<http://humanresearchroadmap.nasa.gov/Gaps/>).

- 2.01 - We do not know the quantified health and mission outcomes due to medical events during exploration missions.
- 2.02 - We do not know how the inclusion of a physician crew medical officer quantitatively impacts clinical outcomes during exploration missions.
- 3.01 - We do not know the optimal training methods for in-flight medical conditions identified on the Exploration Medical Condition List taking into account the crew medical officer's clinical background. (Closed)
- 3.03 - We do not know which emerging technologies are suitable for in-flight screening, diagnosis, and treatment during exploration missions.
- 4.01 - We do not have the capability to provide a guided medical procedure system that integrates with the medical system during exploration missions.
- 4.02 - We do not have the capability to provide non-invasive medical imaging during exploration missions.
- 4.05 - We do not have the capability to measure laboratory analytes in a minimally invasive manner during exploration missions.
- 4.12 - We do not have the capability to generate and utilize sterile intravenous fluid from potable water during exploration missions.
- 4.14 - We do not have the capability to track medical inventory in a manner that integrates securely with the medical system during exploration missions.
- 4.15 - Lack of medication usage tracking system that includes automatic time stamping and crew identification
- 4.17 - We do not have the capability to package medications to preserve stability and shelf-life during exploration missions.
- 4.19 - We do not have the capability to monitor physiological parameters in a minimally invasive manner during exploration missions.
- 4.22 - Limited capability to diagnose and treat radiation sickness (Closed)
- 4.23 - We do not have the capability to auscultate, transmit, and record body sounds during exploration missions.
- 4.24 - Lack of knowledge regarding the treatment of conditions on the Space Medicine Exploration Medical Condition List in remote, resource poor environments (Closed)
- 5.01 - We do not have the capability to comprehensively manage medical data during exploration missions.

Other Pertinent Documents

List of Acronyms

B	
BZK	Benzalkonium antiseptic
C	
CNS	Central Nervous System
D	
DRM	Design Reference Mission

E	
EMCL	Exploration Medical Condition List
EVA	Extravehicular Activity
G	
GI	Gastrointestinal
H	
HRP	Human Research Program
I	
IM	Intramuscular
ISS	International Space Station
IV	Intravenous
M	
MB	Megabyte
N	
NASA	National Aeronautics and Space Administration
NEA	Near Earth Asteroid
U	
U.S.	United States

References

1. Merck Manual. Nausea and Vomiting, Porter RS, editor. 2011. Whitehouse Station, N.J, Merck Sharp & Dohme Corp. p. 79-81.
2. Marshburn TH. Acute Care. In: Barratt M, Pool S, editors. Principles of Clinical Medicine for Space Flight. New York: Springer; 2008. p. 101-22.
3. Diskin A. Gastroenteritis in Emergency Medicine. Dronen S, editor. WebMD - Medscape Reference. 10-22-2009. New York, WebMD. 8-12-2011.

Last Update

This topic was last updated on 8/12/2014 (Version 2).

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Category: Medical Conditions

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